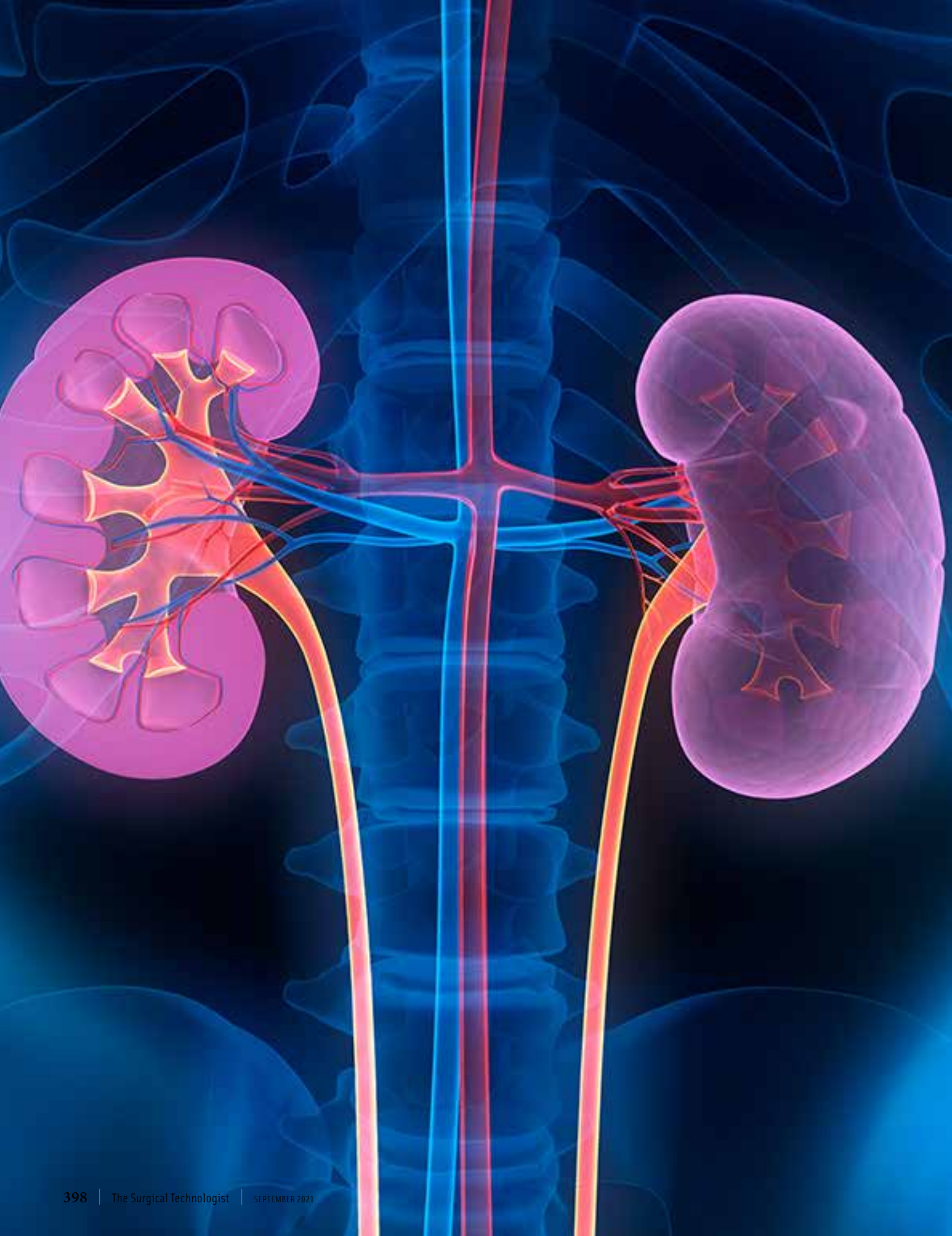


Robot-Assisted Radical Nephrectomy with Inferior Vena Cava Thrombectomy

Julian Kingsley, CST; Kelley McCarty, CST, CSFA; Jesse Sammon, DO

Inferior vena cava (IVC) thrombus is an uncommon complication of renal cell carcinoma (RCC) which indicates a particularly aggressive cancer and has historically had a poor prognosis. While open surgery to remove IVC tumor thrombi has been practiced for decades, and remains the predominant surgical method, a robotic approach to this procedure has been described in literature for the past 10 years. This article will discuss the surgery at length, both the risks and benefits, as well as a step-by-step description of the procedure itself. The objective of this article is to prepare the surgical technologist to assist in this complex urologic case. Although this article will describe the technique for surgery on a right kidney, the procedure for a left kidney is similar.

BACKGROUND

Of the over 100 types of cancers seen in surgical patients, renal cell carcinoma (RCC) represents about 3% of solid adult neoplasms and is the most common malignant tumor occurring from the renal parenchyma.[7] While most RCCs are asymptomatic, signs and symptoms may include hematuria, lower back pain on one side, a palpable mass, fatigue, loss of appetite, anemia, and persistent fever not associated with an infection. RCC can also present with a tumor thrombus extending into the inferior vena cava (IVC); when present, an IVC thrombus makes surgical management significantly more complex. Between 4-10% of RCC patients present with venous extension of the tumor from the renal vein to the IVC,[7] and the presence of a tumor thrombus is associated with aggressive cancer variants.[5] Diagnosis of RCC is typically confirmed through a variety of scans and tests, most often including CT scan, MRI scan, ultrasound imaging, urinalysis, and biopsy.

LEARNING OBJECTIVES

- Review the anatomy affected during this procedure
- Detail the procedural steps and whether a cavotomy is needed
- List the instrumentation and supplies needed for this operation
- Explain the pathology that necessitates surgical intervention
- Explore the history of treating renal cell carcinomas

Tumor thrombus level	Open radical nephrectomy, with tumor thrombus	Robot-assisted radical nephrectomy with tumor thrombus	p-value
N	27	24	
Average Length of Stay (days)	7	3	0.03
Average Estimated Blood Loss (mL.)	1800	450	<0.01
Transfusion Rate (%)	82	21	<0.01
Fever Complications (%)	43	17	<0.01

Source: Rose et al, 2020

The predominant method for addressing RCC involving IVC thrombus is open resection, as this allows for the safe handling of the IVC and minimizes the risks of perioperative complications.[9] In fact, prior to the advent of robotic surgery, it was thought that IVC tumor thrombi, need for lymphadenectomy, contiguous organ invasion, and other oncological complications would always require open surgery.[13] However, since 2011,[9] the robot-assisted thrombectomy has become a viable option, and complete surgical resection of the tumor remains the standard practice with the best patient outcomes.[5] Robot-assisted radical nephrectomy with IVC thrombectomy has been shown to be feasible, safe, and effective in treating aggressive RCC in selected patients.[2,5,9,10,13]

As exciting as this new surgical frontier may be, it is not without significant risks. Studies have demonstrated a perioperative mortality rate for patients undergoing IVC thrombectomy of 5-8%.[9] Urologists performing this operation should communicate with their facility's vascular surgery and/or cardiothoracic surgery team beforehand to coordinate and develop a plan for addressing complications. Whether a consultation with vascular or cardiothoracic surgery is indicated will be based on the size of the thrombus and how far up the IVC it extends. Familiarization with robotic IVC thrombectomy techniques may prove crucial for urologists who perform robotic nephrectomies[10] and may help them to expand their practice. For these reasons, meticulous preoperative planning, patient selection, and surgeon experience are essential to preventing perioperative complications.[2,5] In addition to the typical risks of hemorrhage (greatly amplified in this procedure), surgical site infection (SSI), and tumor recurrence, one must consider the potential for unique complications. A tumor thrombus in so large a vessel presents not only a risk of metastasizing, but also of the thrombus either occluding the IVC or embolizing and traveling to the right atrium and potentially points beyond due to a misplaced clamp.

Despite these risks, there are numerous advantages to a robotic approach when compared to an open approach in these patients. One study comparing the robotic approach against the traditional open approach found that "Robotic procedures have been reported to have shorter hospital stays, less blood loss and transfusions, and a lower complication rate" (Kishore et al., 2020). Other studies have shown similar oncologic and survival outcomes.[13] A 2019 study conducted at the Mayo Clinic, specifically comparing open radical nephrectomy with tumor thrombus versus robot-assisted radical nephrectomy with tumor thrombus, concluded that "[Robot-assisted radical nephrectomy with tumor thrombus] produced a shorter length of stay, less transfusions, and a lower rate of complications with no significant difference in overall survival." (Rose et al., 2020).

Tumor thrombus level	Definition	Surgical strategy
0	Tumor thrombus is limited to the renal vein	Radical nephrectomy of renal cell carcinoma
I	Tumor thrombus extend into IVC with <2cm above the renal vein	Tumor thrombus could be extended to renal vein and then radical nephrectomy
II	Tumor thrombus extends into IVC >2cm above the renal vein but below the hepatic veins	The transaction of liver is required; blocking up the section of the IVC underneath hepatic vein
III	Tumor thrombus which extends above the hepatic veins but below diaphragm	The mobilization of the liver; vena-venous bypass is required
IV	Tumor thrombus is above diaphragm	Intraoperative extracorporeal circulation is requisite

Source: Peng, et al, 2020

PATHOLOGY NECESSITATING SURGICAL INTERVENTION

Tumor thrombi extending into the IVC are classified based on their extension along the vena cava, using a system[14] developed in 1987 by Neves & Zincke. A Level I thrombus is one which extends less than 2 cm from the junction of the renal vein and the inferior vena cava. A Level II thrombus extends more than 2 cm from the renal vein but terminates inferior to the hepatic veins. A Level III thrombus extends superior to the hepatic veins, but inferior to the diaphragm. Any tumor thrombus which extends superior to the diaphragm is classified as a Level IV.[15] As venous extension increases, so too does the difficulty of resection, which in turn increases the risk of perioperative morbidity and mortality.[7]

The most common subgroup of RCC, clear cell renal cell carcinoma (ccRCC), often presents with hypervascularity. This common characteristic raises the potential risk of significant bleeding, even in the absence of a tumor thrombus, due to the presence of well-developed collateral vasculature.[7] Though useful in all variations on this procedure, a robotic ultrasound probe will be essential in identifying residual vascular supply after renal artery ligation[9] as well as determining the size and location of the tumor thrombus intraoperatively. Another complication which may contraindicate surgical intervention altogether in the instance of IVC thrombus is metastatic disease. Kamimura et al. (2017) noted that "Although the significance of cytoreductive nephrectomy in metastatic renal cell carcinoma (mRCC) is reported, that of surgical intervention in cases with venous extension is still controversial because of the high perioperative complication and mortality rates." This point continues to show how meticulous patient selection and screening is essential to surgical success.

SUPPLIES

- Basic laparoscopic kidney pack
- Arm positioner
- Foam positioning aids (donuts, arm pads, pillows, headrest, etc. as needed)
- 15mm Endocatch bag
- Vascular stapler
- 5fr open-ended catheter
- 10cc Luer-lock syringe (x4)
- Veress needle
- Laparoscopic suction-irrigator
- Monopolar electrocautery pencil with smoke evacuation
- Skin closure adhesive
- Vessel loops (x4)
- Laparoscopic cholecystectomy drape
- Utility drapes (x4)
- Local anesthetic of surgeon's preference
- Heparinized saline
- Suture as follows:
  - 4-0 polypropylene suture on RB-1 needle (x4) (two cut to 7" with a knot
  - 10mm Hem-O-Lok and Lapra-Ty for cavotomy stitches, and 2 cut to 4" with a knot and Lapra-Ty for "rescue" stitches in the event of inadvertent vascular injury)
  - 0 Vicryl CT-2 (x2)
  - 1 PDS CT-1 (x2)
  - 0 Vicryl UR-6 (x2)
  - 4-0 Monocryl PS-2 (x2)

EQUIPMENT

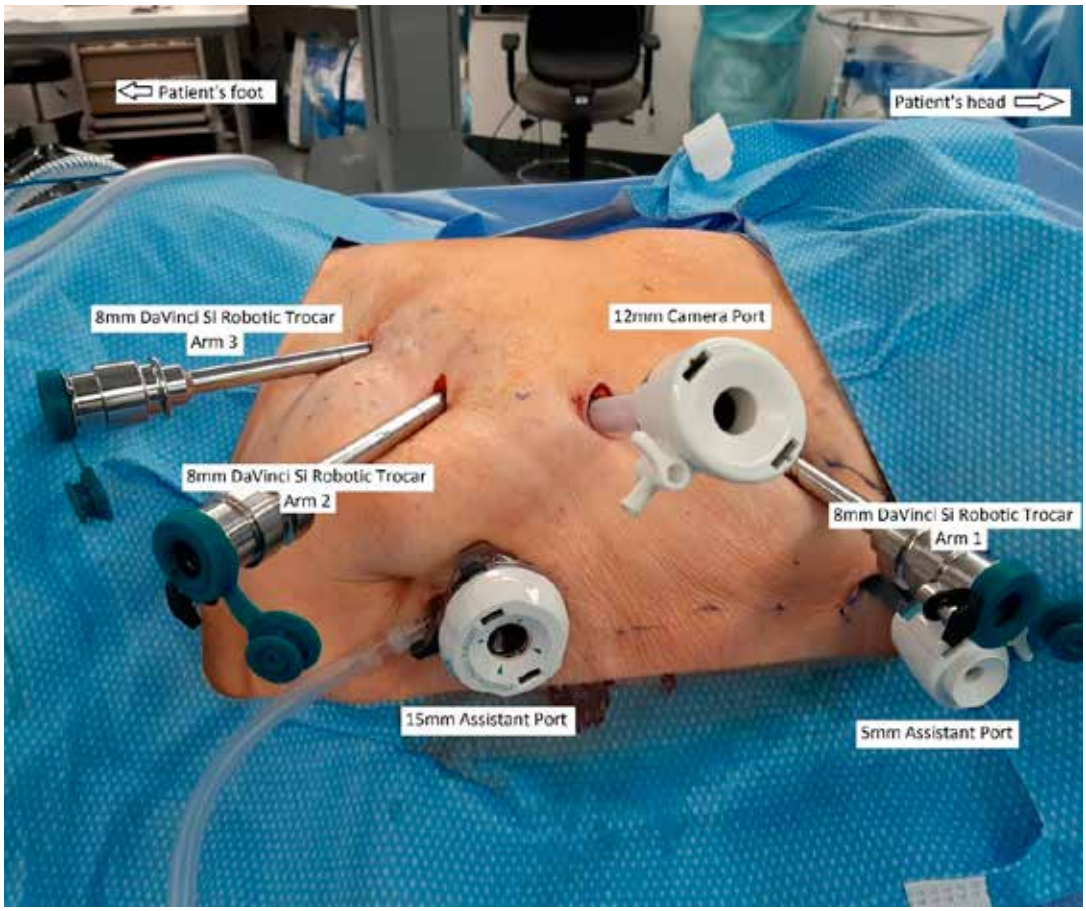
- DaVinci Si robot
- Intraoperative ultrasound with robotic/laparoscopic probe
- Bipolar and monopolar ESUs
- BAIR hugger (upper and/or lower as patient physiology may dictate)

INSTRUMENTATION

- Standard Si reposable instruments (to include monopolar scissors, fenestrated bipolar forceps, and Prograsp forceps)
- Round-tipped robotic scissors
- Laparoscopic atraumatic grasper
- Laparoscopic needle driver
- Laparoscopic scissors
- Urologic open instrumentation (to include various forceps, scissors, long fine-tipped needle drivers, and retractors)
- Major vascular instrumentation (to include Potts scissors, DeBakey peripheral vascular clamps, Satinsky clamps, Garrett vascular dilators, and other large vascular clamps as available)
- Chitwood vascular clamps
- Laparoscopic bulldogs and applier (x2)
- Robotic bulldogs (x4)
- Small, medium, and large Hem-O-Lok appliers and clips (or other laparoscopic clips as available)
- Lapra-Ty applier and clips

PATIENT POSITIONING

Left lateral (right-side up), arm board under left arm, right arm supported by arm positioner. The bed will be flexed to elevate the patient's mid-section and rotated to the patient's right (slightly supinating the patient). The patient will need to be amply padded to prevent pressure ulcers. Once the ports are placed, the robot will be positioned on the patient's right (behind the patient now) and the robot arms come across the patient so that robotic instrument tips will be aimed dorsally.



SPECIAL CONSIDERATIONS

Coordination with vascular surgery is strongly recommended, and it is advisable to have a vascular surgeon present during IVC dissection and cavotomy, if possible, in the event that conversion to open becomes emergently necessary. The patient will ideally have a central line, two intravenous lines, and an arterial line placed before draping to enable real-time vital sign monitoring and rapid fluid volume replacement, if necessary.

PROCEDURAL STEPS[5]

The patient will be prepped with a chlorhexidine gluconate solution and draped. Local anesthetic will be injected, and a small incision will be made using an electrosurgical pencil. Two penetrating towel clamps will be used to elevate the skin and abdominal wall and a Veress needle will be inserted. Once access has been confirmed with a drop test, the insufflation tubing will be attached, and the peritoneum will be insufflated with CO2. The Veress needle will be removed and replaced with a long 12mm laparoscopic port to allow the camera to be inserted. The robotic camera will be brought to the field and once in place, remaining ports will be placed under direct supervision (see image).

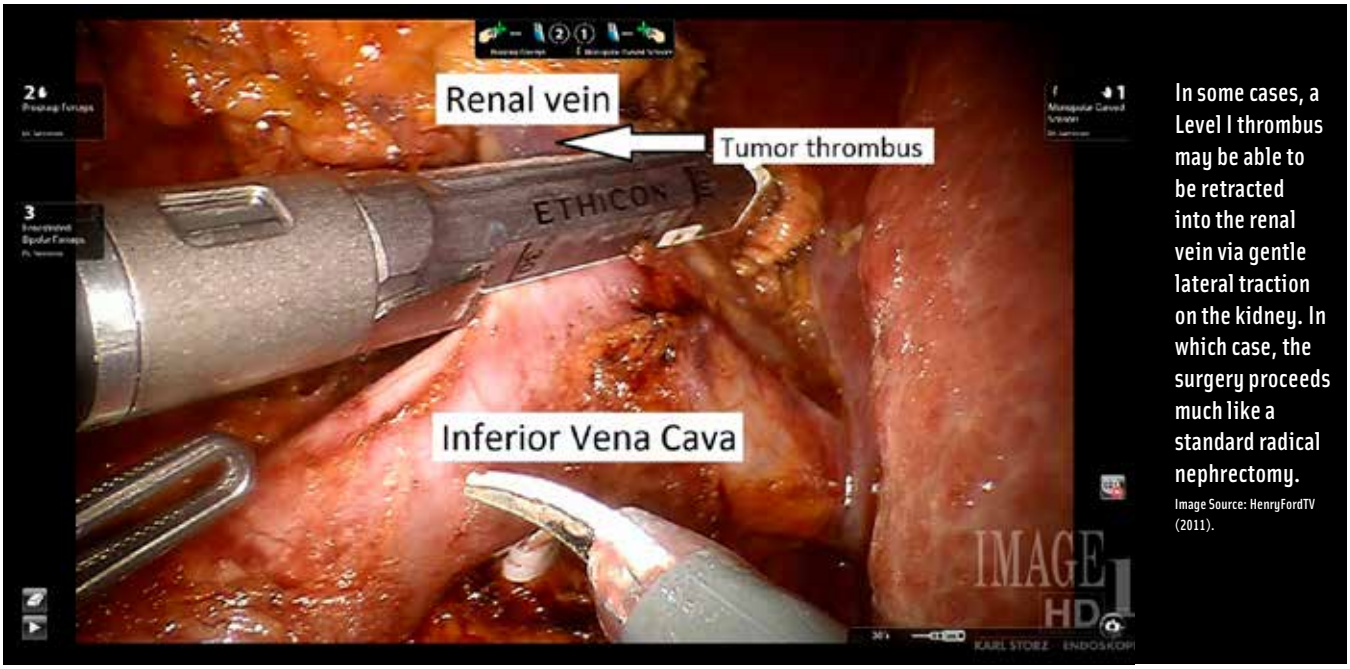
Once access has been established and the ports have been placed, the robot will be docked to the patient from behind, and instruments will be placed as follows, from the surgical technologist's right to left:

Arm 1 – Monopolar curved scissors

Arm 2 – Fenestrated bipolar forceps

Arm 3 – Prograsp forceps

The surgeon will break scrub and take their place in the console. First, any adhesions will be removed and the surgical field will be exposed. The upper pole of the kidney will be carefully dissected first, elevating the lower lobe of the liver off of the anterior surface of Gerota's fascia. A laparoscopic grasper will be placed through the sub-xyphoid 5mm assistant port to retract the liver superiorly. Dissection will continue along the Line of Toldt, freeing the hepatic flexure of the colon, which allows for better access to the lower pole of the kidney, which will be dissected free. The hilum of the kidney will be dissected to visualize the ureter, renal vein, and renal



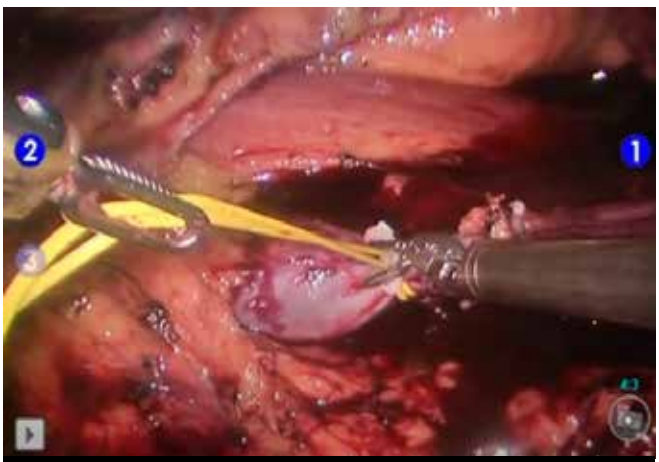
In some cases, a Level I thrombus may be able to be retracted into the renal vein via gentle lateral traction on the kidney. In which case, the surgery proceeds much like a standard radical nephrectomy.

Image Source: HenryFordTV (2011).

artery. The IVC will be dissected circumferentially using an interaortocaval approach. If lumbar veins are encountered which cannot be navigated around, these will be ligated with 10mm Hem-O-Lok clips and cut. The ureter will be skeletonized and ligated with 18mm Hem-O-Lok clips, with two placed distal to the line of transection and one placed proximal so the end with two clips remains in the body. The ureter then will be divided between these clips. The renal artery will be skeletonized and ligated as before, using 10mm Hem-O-Lok clips, and divided.

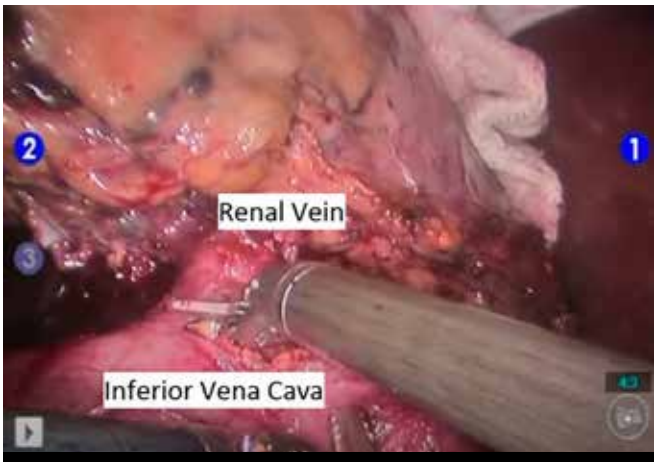
At this point, the ultrasound probe will be introduced via the 15mm assistant port. This will be used to confirm the position of the tumor thrombus. After confirming the size and location of the tumor thrombus, the surgeon will decide whether to proceed with a cavotomy and thrombectomy, or if the tumor can be sufficiently reduced with renal traction, in which case the renal vein will be divided using a stapler with a vascular load as is common in a standard robot-assisted radical nephrectomy. This approach is often feasible for Level 1 thrombi and when achievable allows for a significantly less complex vascular control.

If the surgeon decides to proceed with a cavotomy, three vessel loops will be passed in via the 15mm assistant port. These will be used as Rummel tourniquets on the left renal vein, as well as the IVC, inferior and superior to the thrombus. An ultrasound may be used to confirm the superior and



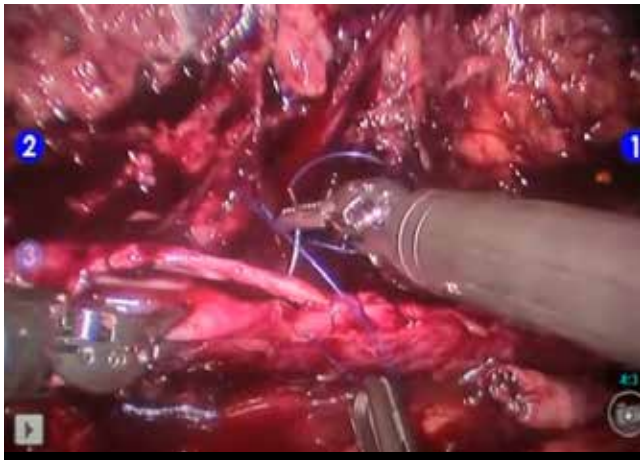
Improvised Rummel tourniquets can be fashioned using a vessel loop and a 10mm Hem-O-Lok clip.

Image Source: HenryFordTV (2011).



The cavotomy will be made on the anterior surface of the vena cava at the junction of the renal vein.

Image Source: HenryFordTV (2011).



The cavotomy is repaired using a 4-0 polypropylene stitch. Care should be taken that the lumen of the IVC is not narrowed more than is necessary.

Image Source: HenryFordTV (2011).

inferior boundaries of the thrombus. The use of vascular clamps is not advised, as inadvertently clamping the thrombus may create an embolus. The tourniquets are doubly looped around the vessels and held in place with a 10mm Hem-O-Lok clip. The order of application will be: left renal vein, inferior IVC, superior IVC.

The cavotomy will be made at the anterior junction of the IVC and right renal vein, then extended superiorly and inferiorly using round-tipped robotic scissors. The thrombus will be carefully delivered through the cavotomy, taking care not to break or sever it. While being removed, the thrombus will be covered with a sponge and gently retracted with the Prograsp forceps.

The cavotomy will be repaired using a 4-0 polypropylene stitch on an RB-1 needle, cut to 7-inches, using a continuous running suture technique. The tail of the stitch is knotted, with a 10mm Hem-O-Lok clip and Lapra-Ty as a bolster. Once the cavotomy repair is nearly complete, the lumen will be flushed with heparinized saline and the repair will be completed. The suture will be secured on the end with a Hem-O-Lok clip and Lapra-Ty. Care needs to be taken that the lumen of the IVC is not narrowed more than necessary.

The Rummel tourniquets will be cut and removed in the same order that they were applied: left renal vein, inferior IVC, superior IVC. The specimen will be placed in a 15mm Endocatch bag and the surgical field will be evaluated for hemostasis. Once the surgeon is satisfied with hemostasis, the robotic and laparoscopic instruments will be removed, and the robot will be undocked from the patient.

The most inferior port site (Arm 3) will be extended to extract the specimen. The peritoneum will be closed using a 0 Vicryl suture on a CT-2 needle and the fascia will be closed with a 1 PDS suture on a CT-1 needle. At this time, local instillation of 30cc 0.25% bupivacaine can be placed below the transversalis fascia as a TAP block for post-operative pain management. Local anesthetic then will be injected subcuticularly, and the skin will be closed with a 4-0 Monocryl suture on a PS-2 needle. The camera and 15mm assistant port sites will be closed with 0 Vicryl sutures on a UR-6 needle, followed by 4-0 Monocryl suture on a PS-2 needle. The remaining port sites will be closed with 4-0 Monocryl suture. Finally, the surgical field will be cleaned and Dermabond will be applied. No dressings are needed if superficial hemostasis has been achieved.

> Coordination with vascular surgery is strongly recommended, and it is advisable to have a vascular surgeon present during IVC dissection and cavotomy, if possible, in the event that conversion to open becomes emergently necessary.

POSTOPERATIVE PROGNOSIS

The procedure of nephrectomy with IVC thrombectomy is associated with a significant risk of perioperative complications including perioperative mortality. Studies of perioperative complications have suggested a rate of 12% to 47%, depending on the thrombus level and mortality rates have been shown to be 5% to 10%.[11]

The risk of complications exists irrespective of the surgical approach, and to date there have been no Level I trials to suggest an improvement in surgical outcomes with robotic assistance. Observational data, however, do suggest that the robotic approach may be associated with decreased length of stay, reduced blood loss, and a decreased risk of perioperative morbidity and mortality, albeit in a population that is very highly selected.[1]

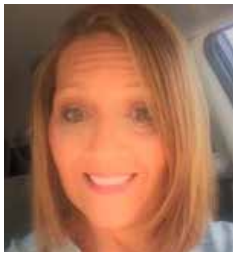
Given the high-risk nature of nephrectomy and IVC thrombectomy, it is important to recall the natural history of RCC with tumor thrombus. In absence of surgical treat-

ment, the median survival for patients with RCCIVCT has been shown to be as little as five months.[16]

Following surgical resection, in the absence of lymph node positive disease, five-year cancer specific survival has been shown to routinely exceed 60-70%.[3,6,8,12]

ABOUT THE AUTHORS

Julian Kingsley has been a Certified Surgical Technologist (CST) since 2019, when he graduated as class valedictorian from the Maine Medical Center School of Surgical Technology. Since graduating, he has served on the Maine State Assembly Board of Directors as a director and is currently serving as secretary. Julian is a full-time surgical technologist at Maine Medical Center in Portland, specializing primarily in genitourinary and gynecologic surgery, with a particular focus in robotic surgery. Before becoming a surgical technologist, Julian received a baccalaureate degree from the University of New England in behavioral psychology, and spent several years working in the fields of law enforcement and social work. Julian also served in the United States Marine Corps Reserve for six years as a rifleman and squad leader in an infantry company.



Kelley McCarty is a Certified Surgical Technologist (CST) and Certified Surgical First Assistant (CSFA). In 2000, she graduated top of her class with an associate degree in surgical technology. She became a seasoned surgical technologist in a wide range of surgical specialties. In 2006, she was elected to the Board of Directors for the Maine State Assembly of the Association of Surgical Technologists. During her eight years she held many positions, from director to president. As president, she took her passion for surgical technology and developed a CST Career Ladder Program for a local hospital. She executed Surgical Technology Recognition Week, a lottery program for educational conferences and developed yearly local CEU conferences for education and networking. To further her career, she became a CSFA. In her 21-year career, she says her greatest accomplishment was creating a certified surgical assistant program and position, allowing surgical technologists to further their education by becoming CSFAs.

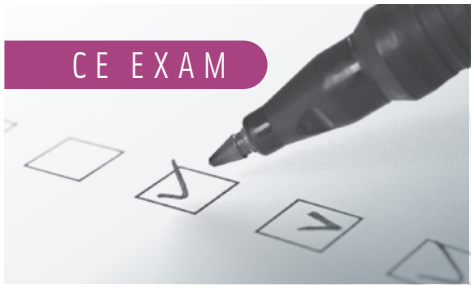
Jesse D. Sammon, DO, is an assistant professor of urology, specializing in robotic surgery for cancers and benign disease of the kidney, ureter, bladder, and prostate. Dr. Sammon graduated UNECOM in 2009, and completed residency and fellowship in urology and robotic urologic oncology at Henry Ford Hospital in Detroit, Michigan, in 2016.

Dr. Sammon has published extensively on minimally invasive urologic oncology, comparative effectiveness, and prostate cancer epidemiology. He has authored/co-authored over 100 peer-reviewed articles and book chapters and has presented at numerous national and international conferences.

References

1. Abaza R, Shabsigh A, Castle E, Allaf M, Hu JC, Rogers C, Menon M, Aron M, Sundaram CP, Eun D. Multi-Institutional Experience with Robotic Nephrectomy with Inferior Vena Cava Tumor Thrombectomy. *J Urol.* 2016 Apr;195(4 Pt 1):865-71. doi: 10.1016/j.juro.2015.09.094. Epub 2015 Nov 19. PMID: 26602891.
2. Ahluwalia, Puneet, et al. "Robotic Radical Nephrectomy and Level II Inferior Vena Cava Thrombectomy: Exploring the Newer Frontiers." *International Brazilian Journal of Urology,* 27 June 2019, www.intbrazjurol.com.br/video-section/20190614_ahluwalia_et_al/.
3. Ciancio G, Manoharan M, Katkoori D, De Los Santos R, Soloway MS. Long-term survival in patients undergoing radical nephrectomy and inferior vena cava thrombectomy: single-center experience. *Eur Urol.* 2010;57(4):667–672. doi: 10.1016/j.eururo.2009.06.009.
4. Hatakeyama, S., Yoneyama, T., Hamano, I., Murasawa, H., Narita, T., Oikawa, M., . . . Ohyama, C. (2013). Prognostic benefit of surgical management in renal cell carcinoma patients with thrombus extending to the renal vein and inferior vena cava: 17-year experience at a single center. *BMC Urology,* 13(1). doi:10.1186/1471-2490-13-47
5. HenryFordTV. (2011, April 06). *Inferior Vena Cava (IVC) THROMBECTOMY - da Vinci robotic surgery* [Video]. YouTube. https://www.youtube.com/watch?v=5JM8KhWhrus
6. Kaag MG, Toyen C, Russo P, et al. Radical nephrectomy with vena caval thrombectomy: a contemporary experience. *BJU Int.* 2011;107:1386. doi: 10.1111/j.1464-410X.2010.09661.x.
7. Kamimura, Toshio, et al. "Surgical Intervention for Renal Cell Carcinoma with Inferior Vena Cava Extension Combined with Laparoscopic Procedure." *Research and Reports in Urology,* Volume 9, 2017, pp. 107–112., doi:10.2147/rru.s134817.
8. Kirkali Z, Van Poppel H. A critical analysis of surgery for kidney cancer with vena cava invasion. *Eur Urol.* 2007;52(3):658–662. doi: 10.1016/j.eururo.2007.05.009.
9. Kishore, Thekke Adiyat, et al. "Robot-Assisted Laparoscopic Radical Nephrectomy and Inferior Vena Cava Thrombectomy: A Multicentre Indian Experience." *Arab Journal of Urology,* vol. 18, no. 2, 2020, pp. 124–128., doi:10.1080/2090598x.2020.1738104.
10. Knight, Richard B, and Cristian P Ilie. "Robot-Assisted Laparoscopic Nephroureterectomy for Urothelial Carcinoma with Inferior Vena Cava Incision and Repair." *Journal of Surgical Case Reports,* vol. 2019, no. 4, 2019, doi:10.1093/jscr/rjz134.

11. Lawindy SM, Kurian T, Kim T et al: Important surgical considerations in the management of renal cell carcinoma (RCC) with inferior vena cava (IVC) tumour thrombus. BJU Int 2012; 110: 926.
12. Martínez-Salamanca JI, Huang WC, Millán I, Bertini R, Bianco FJ, et al. Lessons learned from the International Renal Cell Carcinoma Venous Thrombus Consortium (IRCC-VTC) *Curr Urol Rep.* 2014;15(5):404. doi: 10.1007/s11934-014-0404-7.
13. Murphy, Christopher, and Ronney Abaza. "Complex Robotic Nephrectomy and Inferior Vena Cava Tumor Thrombectomy." *Current Opinion in Urology,* vol. 30, no. 1, 2020, pp. 83–89., doi:10.1097/mou.0000000000000690.
14. Neves, R.J., and Zincke, H. "Surgical Treatment of Renal Cancer with Vena Cava Extension." *British Journal of Urology,* vol. 59, no. 5, 1987, pp. 390–395., doi:10.1111/j.1464-410x.1987.tb04832.x.
15. Peng, C., Gu, L., Yang, L., Wang, B., Huang, Q., Shen, D., . . . Ma, X. (2020). Surgical strategy for the management of renal cell carcinoma with inferior vena cava tumor thrombus. *Evolving Trends in Kidney Cancer.* doi:10.5772/intechopen.73294
16. Reese AC, Whitson JM, Meng MV. Natural history of untreated renal cell carcinoma with venous tumor thrombus. *Urol Oncol.* 2013 Oct;31(7):1305-9. doi: 10.1016/j.urolonc.2011.12.006. Epub 2012 Jan 10. PMID: 22237466.
17. Rose, Kyle M., et al. "Comparison of Open and Robot Assisted Radical Nephrectomy With Level I and II Inferior Vena Cava Tumor Thrombus: The Mayo Clinic Experience." *Urology,* vol. 136, 2020, pp. 152–157., doi:10.1016/j.urology.2019.11.002.
18. Wang, B., Li, H., Ma, X., Zhang, X., Gu, L., Li, X., . . . Zhu, J. (2016). Robot-assisted laparoscopic inferior vena cava thrombectomy: Different sides require different techniques. *European Urology,* 69(6), 1112-1119. doi:10.1016/j.eururo.2015.12.001



Earn CE Credits at Home

You will be awarded continuing education (CE) credits toward your recertification after reading the designated article and completing the test with a score of 70% or better. If you do not pass the test, it will be returned along with your payment.

Send the original answer sheet from the journal and make a copy for your records. If possible use a credit card (debit or credit) for payment. It is a faster option for processing of credits and offers more flexibility for correct payment. When submitting multiple tests, you do not need to submit a separate check for each journal test. You may submit multiple journal tests with one check or money order.

Members this test is also available online at ***www.ast.org.*** No stamps or checks and it posts to your record automatically!

Members: $6 per credit
(per credit not per test)

Nonmembers: $10 per credit
(per credit not per test plus the $400 nonmember fee per submission)

After your credits are processed, AST will send you a letter acknowledging the number of credits that were accepted. Members can also check your CE credit status online with your login information at ***www.ast.org.***

3 WAYS TO SUBMIT YOUR CE CREDITS

Mail to: AST, Member Services, 6 West Dry Creek Circle Ste 200, Littleton, CO 80120-8031

Fax CE credits to: 303-694-9169

E-mail scanned CE credits in PDF format to: ***memserv@ast.org***

For questions please contact Member Services - ***memserv@ast.org*** or 800-637-7433, option 3. Business hours: Mon-Fri, 8:00a.m. - 4:30 p.m., MT

Robot-Assisted Radical Nephrectomy with Inferior Vena Cava Thrombectomy

#453 SEPTEMBER 2021 1.5 CE CREDITS $9

1. **After confirming the size and location of the tumor thrombus, the surgeon will decide whether to proceed with:**
   - **a.** A cavotomy
   - **b.** A thrombectomy
   - **c.** Renal
   - **d.** All of the above

2. **Between ____ of RCC patients present with venous extension of the tumor from the renal vein to the IVC.**
   - **a.** 1-3%
   - **b.** 3-7%
   - **c.** 4-10%
   - **d.** 6-12%

3. **One study comparing the robotic approach against the traditional open approach found that robotic procedures have been reported to have:**
   - **a.** Shorter hospital stays
   - **b.** More transfusions
   - **c.** Lower complication rates
   - **d.** Both a and c

4. **_____ is the most common malignant tumor occurring from the renal parenchyma.**
   - **a.** Renal cell carcinoma
   - **b.** Hepatocellular carcinoma
   - **c.** Angiosarcoma
   - **d.** Urothelial carcinoma

5. **A ____ thrombus extends less than 2 cm from the junction of the renal vein and the inferior vena cava.**
   - **a.** Level I
   - **b.** Level II
   - **c.** Level III
   - **d.** Level IV

6. **Which level thrombus extends superior to the hepatic veins, but inferior to the diaphragm?**
   - **a.** Level I
   - **b.** Level II
   - **c.** Level III
   - **d.** Level IV

7. **The IVC will be dissected circumferentially using an:**
   - **a.** Subcostal approach
   - **b.** Interaortocaval approach
   - **c.** Extraperitoneal approach
   - **d.** None of the above

8. **The most common subgroup of RCC, clear cell renal cell carcinoma (ccRCC), often presents with:**
   - **a.** Increased bleeding
   - **b.** Metastatic disease
   - **c.** Hypervascularity
   - **d.** Obesity

9. **If a cavotomy is needed, it will be made at the anterior junction of the:**
   - **a.** Right renal vein
   - **b.** Left renal vein
   - **c.** IVC
   - **d.** IVC and right renal vein

10. **Freeing the hepatic flexure of the ___ allows for better access to the lower pole of the kidney.**
    - **a.** Liver
    - **b.** Colon
    - **c.** Intestines
    - **d.** Bladder

ROBOT-ASSISTED RADICAL NEPHRECTOMY WITH INFERIOR VENA CAVA THROMBECTOMY #453 SEPTEMBER 2021 1.5 CE CREDITS $9

AST Member No. _____

☐ My address has changed. The address below is the new address.

Name _____

Address _____

City _____ State _____ Zip _____

Telephone _____

☐ Check enclosed ☐ Check Number _____

If you want to mail in your CEs, but still want to pay by credit card, give us at call at 800-637-7433.

	a	b	c	d
1	☐	☐	☐	☐
2	☐	☐	☐	☐
3	☐	☐	☐	☐
4	☐	☐	☐	☐
5	☐	☐	☐	☐
6	☐	☐	☐	☐
7	☐	☐	☐	☐
8	☐	☐	☐	☐
9	☐	☐	☐	☐
10	☐	☐	☐	☐

Make It Easy - Take CE Exams Online

You must have a credit card to purchase test online. We accept Visa, MasterCard and American Express. Your credit card will only be charged once you pass the test and then your credits will be automatically recorded to your account.

Log on to your account on the AST homepage to take advantage of this benefit.